



# First record of *Epipactis veratrifolia* Boiss. & Hohen. (Orchidaceae, Epidendroideae, Neottieae, Limodorinae) from an arid wadi in Abu Dhabi, United Arab Emirates

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## Abstract

*Epipactis veratrifolia* is recorded for the first time from Jebel Hafeet, a mountain in Abu Dhabi, United Arab Emirates (UAE). This species had been previously recorded from the northern part of the UAE and other areas on the Arabian Peninsula. The occurrence of *E. veratrifolia* in Jebel Hafeet expands the eastern distribution limits of the species and underlines the importance of biodiversity in the region. The new record fills a gap in the distribution of this species on the Arabian Peninsula.

## Key words

Species monitoring; new record; flora; orchid; Arabian Peninsula.

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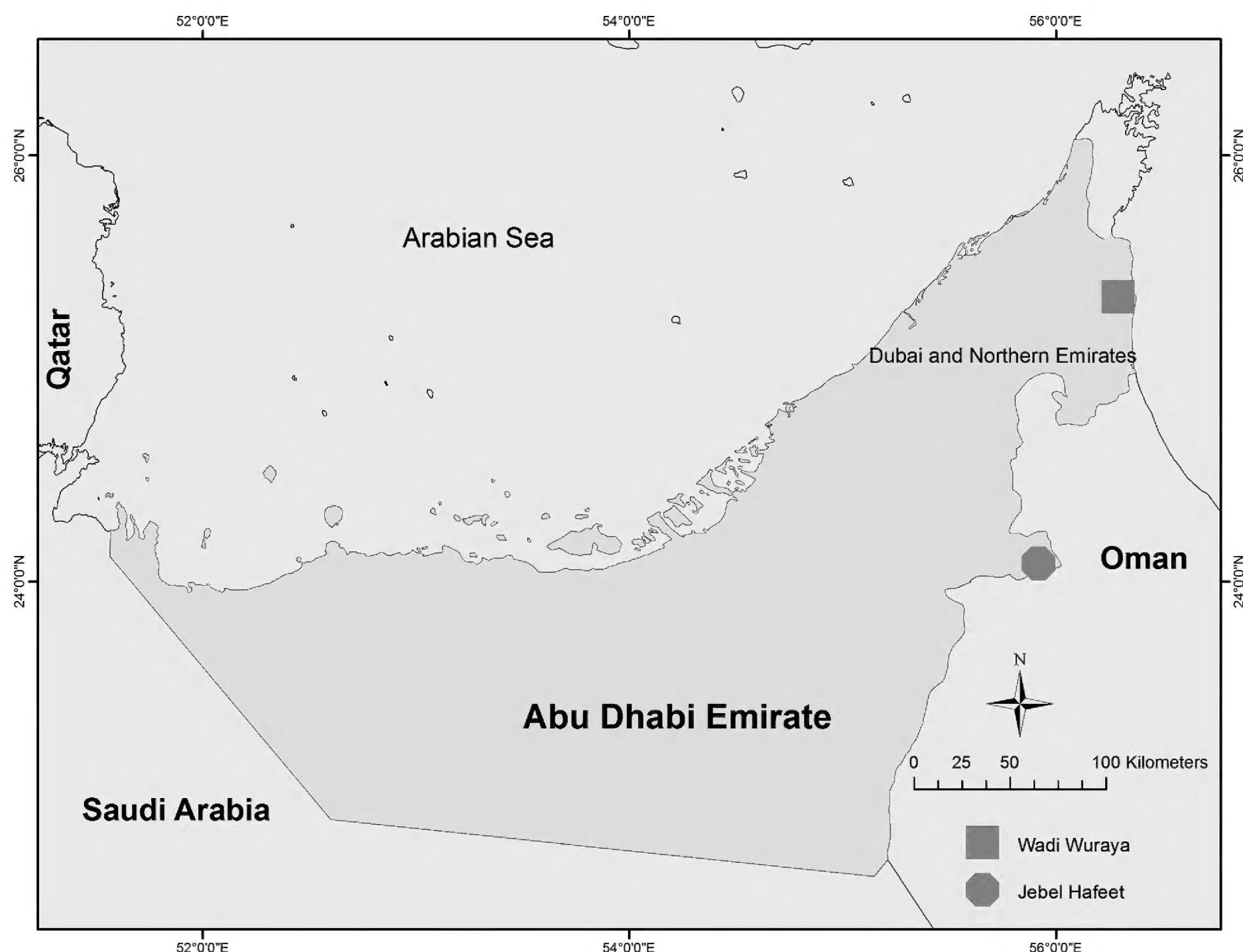
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## Introduction

Abu Dhabi, the largest emirate of the United Arab Emirates (UAE), is spread over a total land area of 67,340 km<sup>2</sup> (SCAD 2015) and represents about 86.7% of the total area of the UAE. Abu Dhabi is comprised of varied natural landscapes. Jebel Hafeet, which is located in the eastern Abu Dhabi, is the most prominent natural landscape (the highest mountain in the emirate) and is known for its rich biodiversity (Sakkir and Brown 2014). This mountain has been the focus of many floristic studies in recent past (Stuart and Stuart 1998, Western 1989, Jongbloed et al. 2003, Brown and Sakkir 2004a, 2004b, Karim and Fawzi 2007, Sakkir and Brown 2014). Jebel Hafeet, due to its elevation (1,240 m above sea level) and

favourable climatic conditions, is floristically rich. With 206 species of vascular plants reported from the region (Sakkir and Brown 2014), it accounts for 47% of the flora of Abu Dhabi. The most important plant families represented here include Poaceae and Asteraceae (Brown and Sakkir 2004a), but the majority of the plant families in the region are represented each by a single genus and species. Biogeographically the flora of UAE shows an affinity to Makran, the coastal region of Iran and Pakistan (Kürschner and Böer 1999).

*Epipactis veratrifolia* Boiss. & Hohen. (Orchidaceae, Epidendroideae, Neottieae, Limodorinae), commonly known as the Eastern marsh helleborine, is recorded here from Jebel Hafeet, and for the first time, from Abu Dhabi emirate. This is the only native orchid species in the UAE



**Figure 1.** Location and distribution map of *Epipactis veratrifolia* in UAE. The green circle (●) indicates the new distribution record of the species. The red square (■) indicates the distribution of the species in the northern part of UAE.

(Brown and Sakkir 2004a, Jongbloed et al. 2003).

Currently, there is limited information available on the orchids of the Arabian Peninsula. A total of 18 species have been recorded from Yemen, 6 species from Oman (Robbins 1992, Cribbs 1979, 1987), and 8 species from Saudi Arabia (Chaudhary 2001). These species are adapted to withstand drought by possessing special water storage organs. All the orchids recorded from Arabian Peninsula are ground orchids, with no species endemic to the peninsula and the majority showing an affinity to Africa (Ghazanfar and Fischer 1998). In the UAE, the Orchidaceae is represented by single taxon, i.e. *Epipactis veratrifolia* (Brown and Sakkir 2004a, Jongbloed et al. 2003).

A detailed description, illustration, habitat ecology, flowering period, population size and threats to the *E. veratrifolia* is provided. At present, the species is categorised as Vulnerable in the UAE, according to IUCN categories and criteria (Ghazanfar et al. 2010).

## Methods

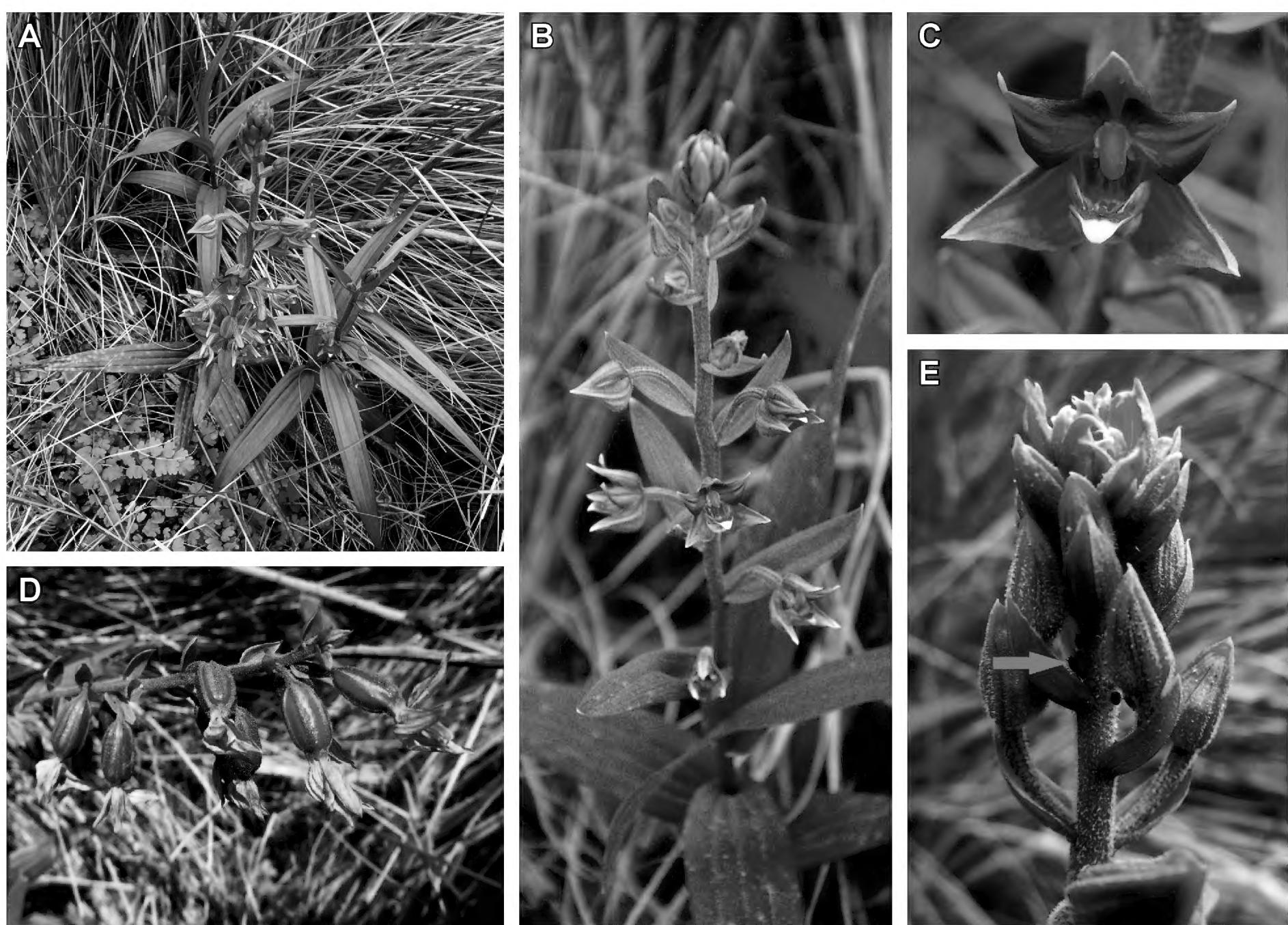
Detailed floristic investigations were carried out between 2001 and 2017 in wadis (ravines) around Jebel Hafeet (Fig. 1). Climatic records indicate that rainfall was most abundant in late summer or early winter, from November to March (Sakkir et al. 2015). Plants were photographed

and their geographic coordinates were recorded. Permission for the collection of specimen was obtained from Environment Agency-Abu Dhabi (EAD). Identification of the plant specimens was done with the help of identification keys in relevant floras (Jongbloed et al. 2003, Collenette 1999) and herbarium specimens from United States Herbarium (National Museum of Natural History, Washington, DC) (US 185045). The description and illustration is based on the specimen collected and on recent literature (Attri et al. 2016, Jongbloed et al. 2003, Collenette 1999). The voucher specimens (EAD2017-15) were deposited in the Herbarium of the EAD. The distribution map was prepared using ArcGIS 10 software (ESRI 2010). The population size was determined by counting the total number of individual plants. The threat status of the species is determined by using IUCN Red List Categories and Criteria (IUCN 2013).

## Results

***Epipactis veratrifolia* Boiss. & Hohen. In P.E.Boissier, Diagn. Pl. Orient. 13: 11 (1854).**

Type: Iran, Infaucibus m. Elbrus pr. Derbend, 27 June 1843, K.G.T.Kotschy 401.



**Figure 2.** *Epipactis veratrifolia*, Jebel Hafeet, January–March 2017. **A.** Habitat. **B.** Inflorescence. **C.** Close-up of flower. **D.** Capsules. **E.** Flower buds infested with aphids (red arrow indicates the aphids).

**Specimen examined.** Abu Dhabi, Jebel Hafeet, from a moist wadi, 1,240 m elev.; 27 December 2016; *Sabitha Sakkir EAD2017-15, EAD2017-16* (EAD).

**Description.** Terrestrial herbs growing from creeping rhizome, up to 40 cm tall, perennial. Stem is covered with fine hairs. Leaves simple and alternate (6–11), ovate, 15 × 2 cm wide, acute, entire, usually green, with sheathing base. Raceme erect, 15–20 cm long with 20–25 flowers. Flowers are borne on 1.5–1.7 cm long pedicel. Sepals 3, 1 dorsal and 2 laterals. Dorsal sepal, elliptic, 9 × 3 mm, acute, entire. Lateral sepals, ovate-lanceolate, 10 × 5 mm, subacute, entire. Petals, ovate-elliptic, 8 × 3 mm, subacute, entire. The margins of the sepals and petals have reddish-purple bands. Labellum, elliptic, 13 mm long, acute, hypochile 4–5 × 2–3 mm, erect lateral lobes, margins curved, epichile, ovate lanceolate, 8–10 × 6–9 mm, fleshy, apex subacute or obtuse. Column 10 mm long, with shortly stalked anther. Pollinia 2, long narrow, 1.5 mm long. Capsule cylindrical-clavate, 9–12 × 7–8–4 × 2 mm wide containing tiny brown to black seeds (Figs 2, 3).

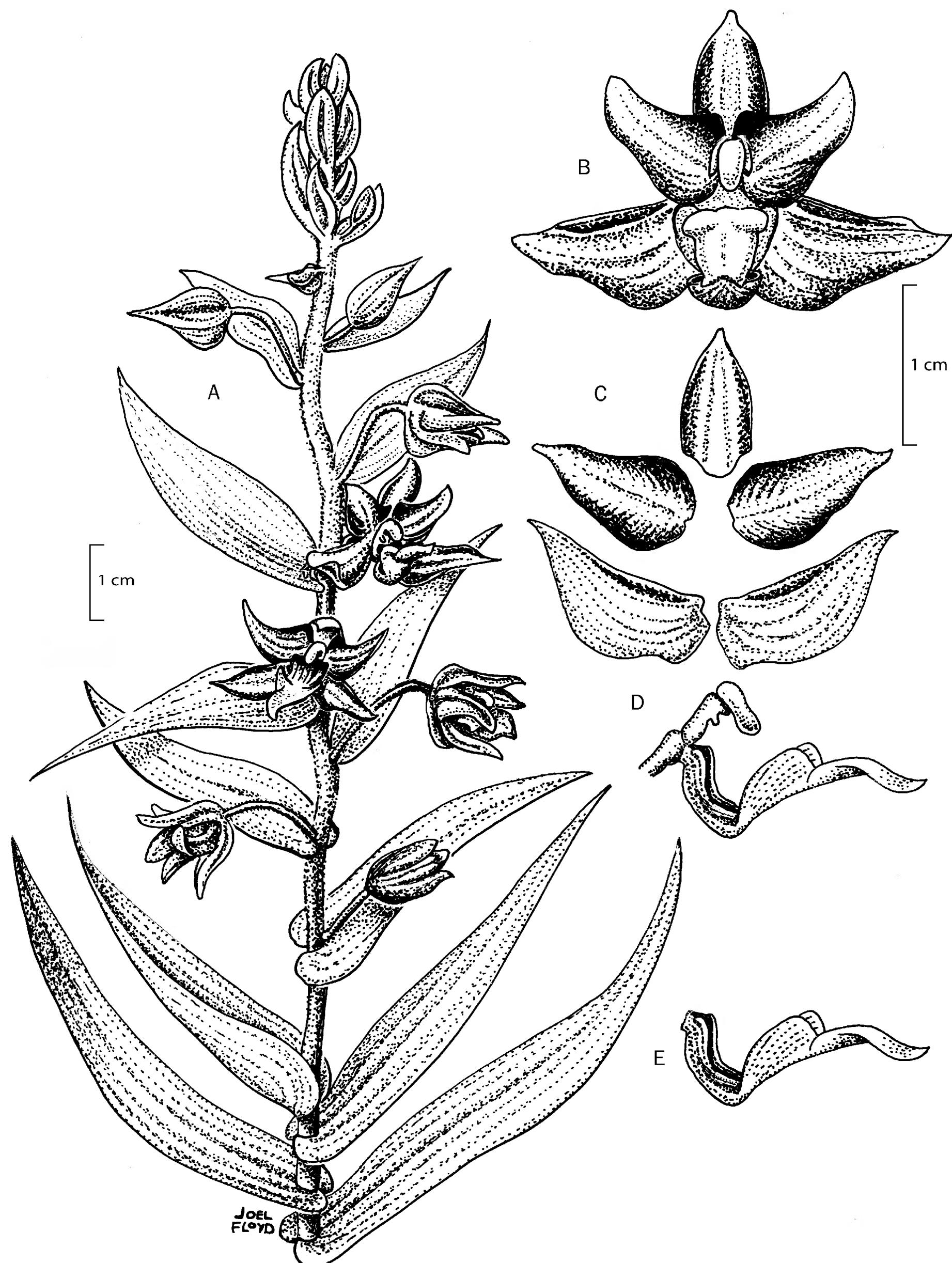
## Discussion

*Epipactis veratrifolia* is recorded for the first time from Jebel Hafeet in Abu Dhabi. This species had been previously recorded from similar habitat types from the northern part of the UAE (Jongbloed et al. 2003, Karim

and Fawzi 2007, Tourenq 2011). Floristic surveys were carried out in neighbouring wadis as well, but no specimens of this orchid species were found.

Vegetation in the Jebel Hafeet wadi was comparatively richer than in the adjoining wadis due to the availability of water. Orchids are known for their specific habitat requirements, and deficiency of any of these requirements leads to their rarity (Cribb et al. 2003). In the same moist wadi as the new record of *E. veratrifolia*, other species were found: the maiden hair fern, *Adiantum capillus-veneris* L. and the reed mace, *Typha domingensis* Pers. The general aspect of the wadi is east-facing, with a man-made source of water at the top. The gradient of this wadi is very steep (nearly 70°), and its approach is fenced, with the result that it has almost no human trespassing, although camera traps record feral goats.

The native range of *E. veratrifolia* extends from Cyprus to Asia and parts of Africa. On the Arabian Peninsula, this species has been recorded from Oman, Saudi Arabia, Yemen, and the UAE (Fay 2013). It occurs at elevations from 1500 to 2500 m above sea level. In Oman, it has been recorded from Jabal Al Awaid in the eastern part of the country and from an oasis settlement in northern Oman (Gebauer et al. 2007, Patzelt 2015). Elsewhere, in Abu Dhabi, the nearest occurrences of this species are in the Hajar Mountains (Feulner 2011, Jongbloed 2003, Tourenq et al. 2011).



**Figure 3.** *Epipactis veratrifolia* Boiss. & Hohen. **A.** Whole plant. **B.** Flower, front view. **C.** Dorsal sepal, petals and lateral sepals. **D.** Labellum with the anther lobe. **E.** Labellum.

The flowering season of *E. veratrifolia* has been observed from early January to late March. The plants were in full bloom in late January. Jongbloed (2003) recorded this species flowering from February to April from the northern UAE. Studies carried out elsewhere have shown that *E. veratrifolia* is pollinated by aphidophagous hoverflies (Kumar and Rawat 2011, Jin et al. 2014). The strategy of deceit pollination was also recorded for this species; that is, the flowers mimic the alarm pheromone of aphids, and thus attract hoverflies (Stökl et al. 2011). Kumar and Rawat (2011) reported vermiculiphily in this orchid species in the Western Himalayas. Adult flies are nectar and pollen feeders and the larvae eat aphids. During the present study, flower buds of *E. veratrifolia* were infested with wingless adult female aphids (Fig 2E), and up to 10 individuals were recorded in December 2016.

The low abundance of *E. veratrifolia* might be due to its specific pollination strategy or due to grazing by feral goats and mountain gazelles. Insect attack, the non-availability of pollinators, and the spread of the fast-growing *Pluchea dioscoridis* L. (DC.) were also recorded. These could be potential threats to *E. veratrifolia* in the UAE.

*Epipactis veratrifolia* is classified as Least Concern globally (Fay 2013), but it is considered Endangered on the Arabian Peninsula (Patzelt et al. 2015). This species is included in Annex B of the CITES (Fay 2013). The population of *E. veratrifolia* at Jebel Hafeet can be conserved by systematic monitoring, protecting the habitat, and *ex situ* conservation methods like seed collection, artificial propagation, and reintroduction. The occurrence of the species in Abu Dhabi demonstrates the importance of wadis on the Arabian Peninsula as special places for biodiversity, especially considering increasing threats and anthropogenic pressures on the environment. This study underlines the importance of specific vegetation types in determining the distribution of orchids. The new distribution record clearly points to a unique habitat of conservation value at Jebel Hafeet and also fills a knowledge gap in this species' distribution on the Arabian Peninsula.

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## Authors' contributions

SS, PS, SA, SBK, AS and SD collected the data, SS wrote the text, and SBK made the distribution map.

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